Remarks

Claims 1-11 have been amended to claim a hydrogen peroxide sterilization indicator. Support for these amendments may be found in the specification at pate 4, lines 1-3, and claim 11.

Claims 21 and 22 have been added to further claim Applicant's invention as taught in the Specification at page 2, lines 6-16, page 4, lines 9-11, and claim 1, as amended.

The Office Action mailed 18 July 2001 has been received and reviewed. Claims 1-11 having been amended and claims 21 and 22 having been added, the pending claims are claims 1-22. Reconsideration and withdrawal of the rejections, based on the above amendments and the following comments, are respectfully requested.

The 35 U.S.C. §103 Rejection

The Examiner rejected claims 1, 5-6, 9-11, 15-16, and 19-20 under 35 U.S.C. §103(a) as unpatentable over Ignacio (U.S. Patent No. 6,063,631) in view of Lent et al. (U.S. Patent No. 4,756,758).

The Examiner rejected claims 2, 4, 12, and 14 under 35 U.S.C. §103(a) as unpatentable over Ignacio (U.S. Patent No. 6,063,631) in view of Davies et al. (U.S. Patent No. 4,863,627).

The Examiner rejected claims 3, 7-8, 13, and 17-18 under 35 U.S.C. §103(a) as unpatentable over Ignacio (U.S. Patent No. 6,063,631) in view of Patel et al. (U.S. Patent No. 5,420,000) and further in view of Barrett (U.S. Patent No. 5,955,025).

Applicant respectfully traverses these rejections.

Ignacio teaches a method of monitoring a hydrogen peroxide sterilization process using a colorant that chemically reacts with the hydrogen peroxide, causing a change in the color of the colorant, indicating that the sterilization process has occurred (Ignacio, column 1, lines 15-

20). Ignacio does not teach the colorants used in Applicant's hydrogen peroxide sterilization indicator.

Lent et al. teach a thermochromic ink used to monitor a heat sterilization process, wherein the ink undergoes a color change in response to a change in thermal environment (Abstract, lines 1-3, 17-19). The ink comprises a heat sensitive dye, a heat resistant dye, and an organic carrier (Lent et al., column 2, lines 44-47). When the ink is exposed to elevated temperatures, from about 116°C to about 127°C, for about 15 to about 30 minutes, the heat sensitive dye chemically decomposes and the color change is accomplished by the presence of the heat stable dye (Lent et al., column 2, lines 47-57 and column 2, line 65 to column 3, line 2).

The hydrogen peroxide sterilization process is an alternative to a heat sterilization process, and generally operates at temperatures below about 80°C, and often below about 65°C. The hydrogen peroxide sterilization process and indicators of Applicant's invention typically take place at a temperature of between about 45°C to about 50°C (Specification, page 4, lines 10-11, and claim 22). The steam sterilization process of Lent operates between about 116°C to about 127°C. There is no teaching or suggestion that the colorants of Lent et al. would produce a color change in the hydrogen peroxide sterilization indicators of Applicant's invention. Furthermore, the colorant Ethyl violet, the only colorant common to both Lent et al. and Applicant's invention, is considered a heat stable dye in Lent et al. (column 4, lines 1-9). Therefore, Lent et al. teach away from Applicant's invention, as Ethyl violet does not change color upon exposure to a heat sterilization process, although it does change color upon exposure to a hydrogen peroxide sterilization process, as disclosed in Applicant's invention (Specification, page 4, line 25, and example 1, Table 1).

As Lent et al. do not teach a colorant that changes color upon exposure to hydrogen peroxide vapor, they do not supply that which is missing from Ignacio. Reconsideration and withdrawal of the rejection of claims 1, 5-6, 9-11, 15-16, and 19-20 under 35 U.S.C. §103(a) over Ignacio in view of Lent et al. is respectfully requested.

Davies et al. teach a contact lens disinfecting composition in solid form for adding to water, yielding a disinfecting agent that is an aqueous solution of hydrogen peroxide, an inactivating agent for inactivating the disinfecting agent, and a color change indicator that produces a visible color change when the disinfecting agent is inactivated (Davies et al., column 3, lines 9-18). Brilliant green and crystal violet are indicators taught in Davies et al. that change from colored in solutions of hydrogen peroxide to colorless when the hydrogen peroxide is reduced by a deactivating agent (Davies et al., column 4, lines 15-17).

The composition of Davies et al. provides a color change indicator used in a disinfecting solution for contact lenses. A disinfectant is a chemical agent that destroys microorganisms but not bacterial spores (Parker et al., eds., *McGraw-Hill Dictionary of Scientific and Technical Terms, 4th edition*, page 557 (1989) Exhibit A, included herewith). Conversely, the indicators of Applicant's invention are used to indicate that a sterilization process has taken place. Sterilization is a process of destroying all forms of microbial life in and on an object (*Id.* at page 1824). There is no teaching or suggestion that the indicators taught in Davies would change color in the same way as the indicators in the presence of the sterilization process of Applicant's invention.

The indicators of Davies et al. including Crystal violet and Brilliant green are colored in the presence of an aqueous solution of approximately 0.13 - 0.35% hydrogen peroxide, and become colorless when the hydrogen peroxide is reduced (Davies et al., column 4, lines 15-17; Examples 5 and 7, column 7, lines 60-63 and column 8, lines 21-22). In the sterilization process of Applicant's invention, the indicators are typically introduced to an atmosphere above an aqueous solution containing at least 30 wt% hydrogen peroxide at a pressure and temperature of about $8x10^2$ to $13.3x10^2$ Pascal and 45C° to 50°C, respectively (Specification, page 4, lines 6-11). Applicant's indicators comprising Crystal violet and Brilliant green yield a visibly different color change in the sterilization process of Applicant's invention

than do the indicators in the disinfecting process of Davies et al. In Applicant's sterilization indicators and process, the composition including Crystal violet is dark blue when no hydrogen peroxide is present (the Crystal violet indicator of Davies et al. is colorless when hydrogen peroxide is removed), and is a lighter blue in the presence of hydrogen peroxide. The Crystal violet indicator of Davies et al. is pink in the presence of hydrogen peroxide (Example 5, column 7, lines 61-62). Additionally, Applicant's composition comprising Brilliant green is colorless in the presence of hydrogen peroxide and colored in the absence of hydrogen peroxide, while the Davies et al. indicators containing Brilliant green are colored in the presence of hydrogen peroxide (column 4, line 16), and colorless in the absence of hydrogen peroxide.

Additionally, the indicators of Davies et al. change to colorless once hydrogen peroxide is removed, indicating that hydrogen peroxide is no longer present. The indicators of Applicant's invention, on the other hand, do not significantly fade once the hydrogen peroxide is removed (Specification, page 4, lines 19-22). Applicant's invention is directed toward monitoring and providing an indication that hydrogen peroxide sterilization has been performed (Specification, page 2, lines 1-2), not necessarily toward monitoring when hydrogen peroxide is removed. It may not, in fact, be desirable for a color change to occur after the hydrogen peroxide is removed, since such a color change may make it unclear whether a hydrogen peroxide sterilization process was performed.

Furthermore, indicator compositions of Applicant's invention are combined with sufficient binder to provide adequate binding of the composition on a substrate (Specification, page 7, lines 11-13), while the colorants used in Davies et al. are dissolved from a tablet to form an aqueous solution including a hydrogen peroxide source and a neutralizing agent. There is no teaching or suggestion that the colorant in hydrogen peroxide solution would provide the color changes of Applicant's indicators in vapor phase hydrogen peroxide.

There is no teaching or suggestion that the disinfection indicators of Davies et al. would change color in the same manner in the presence of the sterilization process of Applicant's

invention. Therefore, Davies et al. cannot be combined with Ignacio to provide that which is missing from Ignacio. Reconsideration and withdrawal of the rejection of claims 2, 4, 12, and 14 under 35 U.S.C. §103(a) as over Ignacio in view of Davies et al. is respectfully requested.

Patel et al. teach a radiation sensitive diacetylene-containing imaging film providing an image that can be permanently dry fixed by a heating step and stored for long periods. Applicant asserts that it is not reasonable for a person of ordinary skill in the art of sterilization indicators to look to the art of enhancing radiation images to find colorants useful for monitoring hydrogen peroxide sterilization, and that there is not necessarily a connection between arts concerned with radiation and those concerned with hydrogen peroxide sterilization. Patel et al. suggest that diacetylenes could be used to monitor short wave length radiation and indicate that medical supplies are sterilized with gamma-ray, X-ray, and electrons (Patel et al., column 31, lines 20-23 and column 32, lines 44-45), however, the invention is directed to imaging films. There are no examples disclosing a composition or method for monitoring a radiation sterilization process. Furthermore, although Patel et al. teach that a red irradiated image may be made darker by dipping the image in a solution of Alkali blue 6B (Patel et al., column 25, lines 34-36), there is no teaching or suggestion in Patel et al. that a diacetylene composition containing Alkali blue would change color in the presence of hydrogen peroxide vapor.

Barrett teaches hydrogen peroxide indicators that can include a decolorization component that reacts to a vapor chemical sterilant such as hydrogen peroxide vapor and a colored component, including Quinacridone red, that is immune to the sterilant (Barrett, column 3, lines 1-3 and column 3, line 61, to column 4, line 10). Applicant also discloses that Quinacridone red is unreactive to hydrogen peroxide; however, Barrett does not teach Applicant's combination of Alkali blue 6B with Quinacridone red to show a color change from

blue to pink upon exposure to a hydrogen peroxide sterilization process (Specification, page 23, line 15, to page 24, line 1),

As Patel et al. are directed toward nonanalogous art, and nonetheless do not teach that which is missing from Ignacio, and Barrett does not teach that which is missing from Patel et al. and Ignacio, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 3, 7-8, 13, and 17-18 under 35 U.S.C. §103(a) over Ignacio in view of Patel et al. and further in view of Barrett.

Summary

It is respectfully submitted that the pending claims 1-22 are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

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CERTIFICATE UNDER 37 CFR §1.8:
The undersigned hereby certifies that this paper is being deposited with the United States Postal Service as first class mail, in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on this 16 day of October, 2001.

By: Ann M. Mueting
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APPENDIX A - SPECIFICATION/CLAIM AMENDMENTS INCLUDING NOTATIONS TO INDICATE CHANGES MADE
Serial No.: 09/453,726
Docket No.: 52951US002

Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted.

In the Claims

For convenience, all pending claims are shown below.

1. **(AMENDED)** A hydrogen peroxide sterilization indicator comprising a substrate and an indicator composition disposed thereon, wherein the indicator composition comprises at least one colorant selected from the group consisting of Malachite green oxalate, Crystal violet, Methyl violet 2B, Ethyl violet, New fuchsin, Victoria blue B, Victoria pure blue BO, Toluidine blue O, Luxol brilliant green BL, Disperse blue 1, Brilliant blue R, Victoria blue R, Quinea green B, Thionine, Meldolas blue, Methylene green, Lissamine green B, Alkali blue 6B, Brilliant green, Spirit soluble HLK BASF, Victoria green S extra, Acid violet 17, Eriochrome black T, Eriochrome blue black B, D & C green no. 2, Spirit soluble fast RR, Spirit soluble fast red 3B, D & C red no. 22, Nitro red, Congo red, Brilliant cresyl blue ALD, Arsenazo 1, Basic red 29, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Mordant brown 1, Reactive black 5, Mordant brown 48, Acid brown AX987, Acid violet AX990, Basic red 15, Mordant red 19, Bromopyrogallol red, and combinations thereof.

2. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 1, wherein the colorant is selected from the group consisting of Malachite green oxalate, Methyl violet 2B, New fuchsin, Toluidine blue O, Luxol brilliant green BL, Quinea green B, Thionine, Meldolas blue, Lissamine green B, Alkali blue 6B, Brilliant green, Victoria green S extra, Eriochrome blue black B, Congo red, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Bromopyrogallol red, and combinations thereof.

3. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 2, wherein the colorant is selected from the group consisting of Malachite green oxalate, Methyl violet 2B, New fuchsin, Quinea green B, Thionine, Meldolas blue, Lissamine green B, Alkali blue 6B, Congo red, Eriochrome blue black B, Bismarck brown R, Methylene violet 3RAX, and combinations thereof.

4. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 2, wherein the colorant is selected from the group consisting of Toluidine blue O, Luxol brilliant green BL Victoria green S extra, Methylene violet, Bromopyrogallol red, Brilliant green, and combinations thereof.

5. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 1, wherein the colorant is selected from the group consisting of Ethyl violet, New fuchsin, Toluidine blue O, Luxol brilliant green BL, Disperse blue 1, Brilliant blue R, Quinea green B, Thionine, Meldolas blue, Methylene green, Lissamine green B, Alkali blue 6B, Brilliant green, Spirit soluble HLK BASF, Victoria green S extra, Acid violet 17, Eriochrome black T, Eriochrome blue black B, D & C green no. 2, Spirit soluble fast RR, Spirit soluble fast red 3B, D & C red no. 22, Nitro red, Congo red, Brilliant cresyl blue ALD, Arsenazo 1, Basic red 29, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Mordant brown 1, Reactive black 5, Mordant brown 48, Acid brown AX987, Acid violet AX990, Mordant red 19, Bromopyrogallol red, and combinations thereof.

6. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 1, wherein the indicator composition further comprises at least one colorant that does not change color upon contact with hydrogen peroxide vapor.

7. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 6, wherein the colorant that does not change color upon contact with hydrogen peroxide vapor is selected from the group consisting Quinacridone red 19, Auramine O, Brilliant blue G, Acid black 24, Patent blue violet, Disperse red 13, Sudan black B, Janus green B, Acridine orange base, Fast green FCF, Patent blue VF, Acid red 97, Sulforhodamine B, Xylenol orange sodium salt, Azure B, Spirit soluble fast yellow G, Keystone soap fluoro green, Calco oil blue N, Oil blue A, Calco oil green, D & C red no. 33, D & C green no.5, Bordeaux R, Xylenol cyanole FF, Crystal scarlet, Basic blue 41, Evans blue, Chicago sky blue 6B, Acid blue 113, Acid blue 120, Acid red 88, Acid red 151, Acid violet 5, Disperse red 1, Direct red 81, Disperse red 19, Sudan red 7B, Basic red 73, Acid green AX986, and combinations thereof.

8. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 7, wherein the indicator composition comprises Alkali blue 6B and Quinacridone red 19.

9. **(AMENDED)** The hydrogen peroxide sterilization indicator of claim 1, wherein the substrate is a polyester film.

10. **(AMENDED)** A hydrogen peroxide sterilization indicator comprising a substrate and an indicator composition disposed thereon, wherein the indicator composition comprises a binder, at least one colorant selected from the group consisting of Malachite green oxalate, Crystal violet, Methyl violet 2B, Ethyl violet, New fuchsin, Victoria blue B, Victoria pure blue BO, Toluidine blue O, Luxol brilliant green BL, Disperse blue 1, Brilliant blue R, Victoria blue R, Quinea green B, Thionine, Meldolas blue, Methylene green, Lissamine green B, Alkali blue 6B, Brilliant green, Spirit soluble HLK BASF, Victoria green S extra, Acid violet 17, Eriochrome black T, Eriochrome blue black B, D & C green no. 2, Spirit soluble fast RR, Spirit soluble fast red 3B, D & C red no. 22, Nitro red, Congo red, Brilliant cresyl blue ALD, Arsenazo

1, Basic red 29, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Mordant brown 1, Reactive black 5, Mordant brown 48, Acid brown AX987, Acid violet AX990, Basic red 15, Mordant red 19, Bromopyrogallol red, and combinations thereof, and at least one colorant that does not change color upon contact with hydrogen peroxide vapor.

11. **(AMENDED)** A method of monitoring a hydrogen peroxide sterilization process, the method comprising exposing an article to be sterilized and the hydrogen peroxide sterilization indicator of claim 1 to hydrogen peroxide vapor.

12. The method of claim 11, wherein the colorant is selected from the group consisting of Malachite green oxalate, Methyl violet 2B, New fuchsin, Toluidine blue O, Luxol brilliant green BL, Quinea green B, Thionine, Meldolas blue, Lissamine green B, Alkali blue 6B, Brilliant green, Victoria green S extra, Eriochrome blue black B, Congo red, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Bromopyrogallol red, and combinations thereof.

13. The method of claim 12, wherein the colorant is selected from the group consisting of Malachite green oxalate, Methyl violet 2B, New fuchsin, , Quinea green B, Thionine, Meldolas blue, Lissamine green B, Alkali blue 6B, Congo red, Eriochrome blue black B, Bismarck brown R, Methylene violet 3RAX, and combinations thereof.

14. The method of claim 12, wherein the colorant is selected from the group consisting of Toluidine blue O, Luxol brilliant green BL, Victoria green S extra, Methylene violet, Bromopyrogallol red, Brilliant green, and combinations thereof.

15. The method of claim 11, wherein the colorant is selected from the group consisting of Ethyl violet, New fuchsin, Toluidine blue O, Luxol brilliant green BL, Disperse

blue 1, Brilliant blue R, Quinea green B, Thionine, Meldolas blue, Methylene green, Lissamine green B, Alkali blue 6B, Brilliant green, Spirit soluble HLK BASF, Victoria green S extra, Acid violet 17, Eriochrome black T, Eriochrome blue black B, D & C green no. 2, Spirit soluble fast RR, Spirit soluble fast red 3B, D & C red no. 22, Nitro red, Congo red, Brilliant cresyl blue ALD, Arsenazo 1, Basic red 29, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Mordant brown 1, Reactive black 5, Mordant brown 48, Acid brown AX987, Acid violet AX990, Mordant red 19, Bromopyrogallol red, and combinations thereof.

16. The method of claim 11, wherein the indicator composition further comprises at least one colorant that does not change upon contact with hydrogen peroxide vapor.

17. The method of claim 16, wherein the colorant that does not change color upon contact with hydrogen peroxide vapor is selected from the group consisting of Quinacridone red 19, Auramine O, Brilliant blue G, Acid black 24, Patent blue violet, Disperse red 13, Sudan black B, Janus green B, Acridine orange base, Fast green FCF, Patent blue VF, Acid red 97, Sulforhodamine B, Xylenol orange sodium salt, Azure B, Spirit soluble fast yellow G, Keystone soap fluoro green, Calco oil blue N, Oil blue A, Calco oil green, D & C red no. 33, D & C green no.5, Bordeaux R, Xylenol cyanole FF, Crystal scarlet, Basic blue 41, Evans blue, Chicago sky blue 6B, Acid blue 113, Acid blue 120, Acid red 88, Acid red 151, Acid violet 5, Disperse red 1, Direct red 81, Disperse red 19, Sudan red 7B, Basic red 073, Acid green AX986, and combinations thereof.

18. The method of claim 17, wherein the indicator composition comprises Alkali blue 6B and Quinacridone red 19.

19. The method of claim 11, wherein the substrate is a polyester film.

20. The method of claim 11, wherein the binder is shellac.

21. **(NEW)** The hydrogen peroxide sterilization indicator of claim 1, wherein the colorant is selected from the group consisting of of Malachite green oxalate, Methyl violet 2B, Ethyl violet, New fuchsin, Victoria blue B, Victoria pure blue BO, Toluidine blue O, Luxol brilliant green BL, Disperse blue 1, Brilliant blue R, Victoria blue R, Quinea green B, Thionine, Meldolas blue, Methylene green, Lissamine green B, Alkali blue 6B, Spirit soluble HLK BASF, Victoria green S extra, Acid violet 17, Eriochrome black T, Eriochrome blue black B, D & C green no. 2, Spirit soluble fast RR, Spirit soluble fast red 3B, D & C red no. 22, Nitro red, Congo red, Brilliant cresyl blue ALD, Arsenazo 1, Basic red 29, Bismarck brown R, Methylene violet, Methylene violet 3RAX, Mordant brown 1, Reactive black 5, Mordant brown 48, Acid brown AX987, Acid violet AX990, Basic red 15, Mordant red 19, Bromopyrogallol red, and combinations thereof.

22. **(NEW)** The method of claim 11, wherein the article to be sterilized and the hydrogen peroxide sterilization indicator are exposed to hydrogen peroxide vapor at a temperature of about 45°C to about 50°C and a pressure of about $8x10^2$ Pascals to about $13.3x10^2$ Pascals.